forms of Chelles and of Saint-Acheul. M. Boule states that in addition to the usual almond forms, there are discs, scrapers, small carefully made, and even plates skillfully cut, things one would hardly except to find in a deposit of this sort. It is the first time, adds the author, that indisputable objects of human industry have been found contemporary with an elephant of which the species has, heretofore, been characteristic of the Pliocene age. (Revue Scientifique, Août, 1895).

The Latest Connection between the Atlantic and Pacific Oceans.—Before the Geological Section of the American Association for the Advancement of Sciences assembled in Springfield, Dr. J. W. Spencer presented a short abstract of some investigations of no small interest to biologists, under the title of "Geological Canals between the Atlantic and Pacific Oceans." In extending his researches on the great changes of level of land and sea and the evolution of the present continental reliefs, the author carried his explorations to the Tehuantepec Isthmus. In that region he found that late in the Pleistocene period there were shallow straits connecting the Atlantic and Pacific Oceans, in a region now elevated about 1000 feet above sea level. The deeper parts of these straits evidently formed canals, now elevated 800 feet. These discoveries show for the first time the very late Pleistocene connection between the two oceans, and the occurrence of shallow waters which have permitted considerable intermingling of littoral fishes and invertebrates, while excluding from the Gulf of Mexico all deep sea fishes, and thus explaining in part the distribution of modern marine life in the waters adjacent to Central America.

BOTANY.

Notes on Recent Botanical Publications.—In the Contributions from the Gray Herbarium of Harvard University (New Series, No. IX), B. L. Robinson and J. M. Greenman publish papers on (1) The flora of the Galapagos Islands, as shown by the collections of Dr. G. Baur; (2) New and noteworthy plants chiefly from Oaxaca, collected by Messrs. C. G. Pringle, L. C. Smith and E. W. Nelson; (3) A synoptic revision of the genus Lamourouxia; (4) Miscellaneous New Species.—The List of plants obtained on the Peary Auxiliary Expedi-

tion of 1894, collected by Dr. H. E. Wetherel has been published in Bulletin No. 5 of the Geographical Club of Philadelphia. It contains 108 species as follows: flowering plants, 77; fernworts, 5; mosses and liverwort, 6; algæ, 2; fungi, 2; lichens, 16. Twenty-two families of flowering plants were represented as follows: *Gramineæ*, 12; *Caryophyllaceæ*, 10; *Cruciferæ*, 8; *Cyperaceæ*, 6; *Rosaceæ*, *Saxifragraceæ*, *Ericaceæ*, *Scrophulariaceæ*, 5 each; *Compositæ*, 4; *Ranunculaceæ*, *Onagraceæ*, *Polygonaceæ*, *Salicaceæ*, 2 each; *Papaveraceæ*, *Portulacaceæ*, *Diapensiaceæ*, *Plumbaginaceæ*, *Boraginaceæ*, *Betulaceæ*, *Empetaceæ*, *Liliaceæ*, *Juncaceæ*, 1 each.—Recent Contributions from the Herbarium of Columbia College contain papers by Mrs. Elizabeth G. Britton (72) on the Systematic Position of *Physcomitrella patens*, and a couple of hybrid mosses; by John K. Small (73) some new hybrid oaks from the Southern States (*Quercus phellos* × *digitata*, *Q. georgiana* × *nigra*, *Q. catesbœi* × *cinerea*); by George V. Nash (74) notes on some Florida plants (including a number of new species); by N. L. Britton and Anna M. Vail (75) an Enumeration of plants collected by M. E. Penard in Colorado during the summer of 1892; by Albert Schneider (76) the biological status of lichens; by N. L. Britton (77) new or noteworthy North American Phanerogams (including several new species, one being *Ranunculus allegheniensis*, from the Mountains of Virginia and North Carolina).—From the Proceedings of the American Microscopical Society for 1894, we have two valuable papers, viz.: The Aeration of Organs and Tissues in Mikania and other Phanerogams, by W. W. Rowlee, and the Structure of the fruit in the order *Ranunculaceæ*, by K. M. Wiegand. Both are fully illustrated by good plates.—Professor V. M. Spalding's paper on the Traumatropic Curvature of roots (*Annuals of Botany*, Dec., 1894) familiarizes us with a new word, and gives a somewhat different explanation to root motions than that made by Mr. Darwin.—In the contributions from the Subtropical Laboratory of the Division of Vegetable Pathology of the U. S. Department of Agriculture (pub. in Report of Mo. Bob. Garden, Vol. 6) Herbert J. Webber gives the results of his studies on the dissemination and leaf reflexion of *Yucca aloifolia* and other species. Some interesting adaptations are shown by the author The leaf reflexion is shown to be a protective device against climbing animals which would be tempted by the succulent fruits.—"American Nomenclature" is the title of a long article by the editor of the *Journal of Botany* (London) in the July issue. The most remarkable part of the paper is that quoted anonymously from an American letter, in which occur some astonishing statements, e. g. "We are now in a very

critical position in this country." "I do not know what the result will be." "You have no conception of the violence of the discussions on nomenclature now going on in this country." It is not conceivable that any reputable botanist would write thus of his fellow workers, and the editor of the *Journal* must have been imposed upon by some petty writer.—CHARLES E. BESSEY.

Fertilization of the Yellow Adder's-Tongue (*Erythronium americanum*).—The common Dog-Tooth Violet or Adder's-Tongue differs remarkably from its nearest ally, the tulip, in its method of fertilization. The blossoms of the latter being deficient in nectar in this country, are visited by small bees for the pollen only. Observations made by me in the spring of 1888 upon the Adder's-Tongue show that small drops of nectar are secreted at the base of the inner petals of the perianth, and that male bees (*Nomada luteola*), together with female bees of the genus *Halictus*, visit the flowers for this nectar, searching the base of the stamens and inner petals to secure it.

W. H. PATTON, Hartford, Conn.

"Aboriginal" Botany.—Mr. F. V. Coville, the Chief of the Division of Botany, and Honorary Curator of the Department of Botany of the U. S. National Museum has issued directions for collecting specimens and information illustrating the aboriginal uses of plants. Information of this kind is so important that it is desirable that more attention should be given to obtaining it by all who have the opportunity. It is suggested that the following points should be kept in mind. (1) Specimens of the plants or parts of plants used for any purpose by the Indians should be secured in such condition as to be readily identified by botanists, and accompanied by notes and memoranda. (2) Specimens of all kinds of manufactures from plants are desired by the National Museum. (3) Great care should always be taken to properly, and fully label every specimen of whatever kind, since much of its value depends upon such data as can be given only by the collector. We would urge all who may be able to contribute to our knowledge in the matter to send to the National Museum for a copy of these directions.

New Species of Physalis.—In the July number of the *Torrey Bulletin* Mr. P. A. Rydberg describes four new species and one new variety of *Physalis*, a genus of which he is preparing a monograph. The new species are as follows, viz.: *Physalis subulata*, from Mexico; *P. comata* from Nebraska, Kansas and Texas; *P. versicolor*, from New

Mexico, Arizona and Mexico; *P. versicolor microphylla* from Mexico; *P. macrophysa*, from Arkansas, Kansas, Texas, and doubtfully North Carolina and Ohio.

The Mycetozoa.—These organisms which have generally been regarded as plants, and which are treated in the ordinary botanical works under the name of Slime Moulds have been recently studied more from a biological standpoint by Arthur Lister, the results of which have been brought out by the trustees of the British Museum in the form of a monograph of the group.[1] The work is of such interest to students of this group that we quote the following selections from the introduction since they contain so much of general information regarding these curious organisms.

"Fries gave the name of *Myxogastres* in 1833, to the group of organisms described in this Monograph, placing it among the Gasteromycetous Fungi. In 1836 Wallroth substituted the term *Myxomycetes* (Schleimpilze) for the older name, and this came to be the generally accepted designation. Later investigations showed that the spores, instead of producing a mycelium, as in the case of fungi, gave birth to swarm-cells, which coalesce to form a plasmodium. In consequence of this discovery, which indicated a relationship with the lower forms of animal life, De Bary in 1858 introduced the name *Mycetozoa*. Under this head he still retained the term *Myxomycetes* for the section so named by Wallroth, but linked with them the *Acrasieæ* of Van Tieghem, a small group inhabiting the excrement of animals; in these the spores are said to produce swarm-cells, as in the *Myxomycetes*, which multiply by division but do no coalesce to form a plasmodium. At a certain period, when the fruits are about to be formed, they become attached in branching strings which concentrate to a point, where they are massed together in aggregations of more or less definite shape; the swarm-cells, however, do not lose their individuality. In *Dictyostelium*, a genus of the *Acrasieæ*, a stalk is formed by the arrangement of a number of swarm-cells in vertical rows in the centre of the heap; the surrounding amœboid bodies creep up this stalk and form a globose cluster at the extremity; here each amœboid swarm-cell acquires a spore-wall, and they become a naked aggregation of spores not enclosed by a definite sporangium-wall. Rostafinski followed De Bary in the

[1] *A Monograph of the Mycetozoa*, being a descriptive catalogue of the species in the Herbarium of the British Museum; illustrated with 78 plates and 51 woodcuts by Arthur Lister, F. L. S. London, 1894. 224pp. 8vo.

view that the formation of a plasmodium indicates a wide separation in the natural position of the *Myxomecetes* from the fungi, but he suppressed that name entirely, adopting De Bary's class name *Mycetozoa* in its place; at the same time, he admitted into his Monograph *Dictyostelium*, a genus of the *Acrasieæ*. The reason for his including this genus may be the fact pointed out by De Bary, that Brefeld in first describing the dense aggregations of swarm-cells into the stalked spore-masses of *Dictyostelium*, refers to them as being "plasmodia; that is, products of the coalescence of swarm-cells;" and it was not until after the publication of Rostafinski's Monograph that Van Tieghem in 1880 and Brefeld in 1884 corrected this view. Accepting the *Mycetozoa* as established by Rostafinski, but excluding *Dictyostelium* on the ground of its not forming a true plasmodium, we have a clearly defined group of organisms separated from all others by the following combination of characters. A spore provided with a firm wall produces on germination an amœboid swarm-cell which soon acquires a flagellum. The swarm-cells multiply by division and subsequently coalesce to form a plasmodium which exhibits a rhythmic streaming. The plasmodium gives rise to fruits which consist of supporting structures and spores; in the *Endosporeæ* these have the form of sporangia, each having a wall in which the free spores are developed. A capillitium or system of threads forming a scaffolding among the spores is present in most genera. In the *Exosporeæ* the fruits consist of sporophores bearing numerous spores on their surface.

The affinities of the *Mycetozoa* have been dealt with by de Bary and Zopf in the works before referred to. It had been suggested that they were allied to the fungi through the *Chytrideæ*, which do not always form a mycelium, and in which the entire vegetative body is finally transformed into a many spored sporangium, the vegetative body and spores having the power of amœboid movement for a longer or shorter time. De Bary, however, mentions among other points of difference that the *Chytrideæ* do not form a plasmodium by the coalescence of swarm-cells, "and there is, therefore, no ground for assuming their direct relationship with the *Mycetozoa*."

The position of the *Acrasieæ* in which the swarm-cells exhibit amœboid movements, but do not produce a flagellum, and aggregate without coalesceing into a true plasmodium, has already been referred to. The view held by De Bary that the *Mycetozoa* are more closely associated with the *Protozoa* is supported by a comparison with the pelagic *Protomyxa* of Hæckel, which is stated to develope a plasmodium by the coalescence of swarm-spores, and differs from the *Mycetozoa*

chiefly in the absence of a firm spore membrane; also by comparison with *Bursulla*, which, according to Sorokin, forms a true plasmodium and minute sporangia on horse dung; the spores do not become invested by a firm membrane, and escape from the swollen apex of the sporangium in the form of swarm-cells, without cilia, but capable of amœboid movement. Zopf extends the *Mycetozoa* so as to embrace the *Monadineæ* of Cienkowski, but De Bary maintains that, whatever may be the points of agreement between the *Monadineæ* and the *Mycetozoa* they are not such as to warrant their being classed with the latter division as defined by himself. Lankester accepts the groups as defined by de Bary, and places them in his grade *Gymnomyxa* of *Protozoa;* he suggests their affinity with the *Sporozoa*. The ingestion of bacteria by the swarm-cells appears to strengthen the view that the group is more nearly associated with the lower forms of animal than of vegetable life, and the name of *Mycetozoa* appears to mark its true position in the borderland between the two kingdoms. For a more complete discussion of this subject I must refer to those who have paid special attention to the allied groups.

In preparing this catalogue of the collection of *Mycetozoa* in the British Museum, the arrangement of orders and genera given by Rostafinski in his Monograph has been mainly followed, with such alterations as observations made during recent years have rendered necessary. DeBary made the group the subject of minute and thorough investigation; and Rostafinski, while studying under him at Strassburg, devised a system of classification which is clear and comprehensive, and is now generally accepted.

The division by Rostafinski of the main section *Endosporeæ* into two parts, distinguished by the color of the spores, has been objected to as being artificial and wanting in universal application, but the cases in which species offer difficulty with regard to their position under this scheme are few, and on the whole the organisms range themselves under the separate heads in a remarkably natural manner, while for determining the species the plan is simple and convenient."

Synopsis of the Orders and List of the Genera of the Mycetozoa.

Subclass I.—EXOSPOREÆ. Spores developed outside the sporophores.

Order I.—Ceratiomyxaceæ. Sporophores membranous, branched; spores white, borne singly on filiform stalks arising from the areolated sporophore. Gen. *Ceratiomyxa.*

Subclass II.—ENDOSPOREÆ. Spores developed inside the sporangium.

Cohort I.—AMAUROSPORALES. Spores violet, or violet-brown, except in *Stemonitis* and *Comatricha*, in a few species of which they are pale ferruginous.

Subcohort I.—CALCARINEÆ. Sporangia provided with lime (calcium carbonate).

Order I.—Physaraceæ. Lime in minute innate granules. Gen. *Badhamia, Physarum, Fuligo, Cienkowskia, Physarella, Craterium, Leocarpus, Chondrioderma, Trichamphora, Diachœa.*

Order II.—Didymiaceæ. Lime in crystals. Gen. *Didymium, Spumaria, Lepidoderma.*

Subcohort II.—AMAUROCHÆTINEÆ. Sporangia without lime.

Order I.—Stemonitaceæ. Sporangia simple. Gen. *Stemonitis, Comatricha, Enerthenema, Lamproderma, Clastoderma.*

Order II.—Amaurochætaceæ. Sporangia combined into an æthalium. Gen. *Amaurochæte, Brefeldia.*

Cohort II.—LAMPROSPORALES. Spores variously colored, never violet.

Subcohort I.—ANEMINEÆ. Capillitium wanting, or not forming a system of uniform threads.

Order I.—Heterodermaceæ. Sporangium-wall membranous, beset with microscopic round granules, and (except in *Lindbladia*) forming a net in the upper part. Gen. *Lindbladia, Cribraria, Dictydium.*

Order II.—Liceaceæ. Sporangium-wall cartilaginous; sporangia solitary. Gen. *Licea, Orcadella.*

Order III.—Tubulinaceæ. Sporangium-wall membranous, without granular deposits; sporangia tubular, compacted. Gen. *Tubulina Siphoptychium, Alwisia.*

Order IV.—Reticulariaceæ. Sporangia combined into an æthalium, the sporangium-wall incomplete, perforated or forming a spurious capillitium. Gen. *Dictydiæthalium, Enteridium, Reticularia.*

Subcohort II.—CALONEMINEÆ. Capillitium present, a system of uniform threads.

Order I.—Trichiaceæ. Capillitium consisting of free elaters, or combined into an elastic network with thickenings in the form of spirals or complete rings. Gen. *Trichia, Oligonema, Hemitrichia, Cornuvia.*

Order II.—Arcyriaceæ. Capillitium combined into an elastic network with thickenings in the form of cogs, half rings, spines, or warts (scanty and often reduced to free threads in *Perichœna corticalis*). Gen. *Arcyria, Lachnobolus, Perichœna.*

Order III.—Margaritaceæ. Capillitium not consisting of free elaters, nor combined into an elastic network. Gen. *Margarita, Dianema, Prototrichia.*

Order IV.—Lycogalaceæ. Sporangia forming an æthalium, capillitium consisting of smooth or wrinkled branching colorless tubes. Gen. *Lycogala.*

VEGETABLE PHYSIOLOGY.[1]

Bactericidal Action of Metals.—Under the title, "The effects of various metals on the growth of certain Bacteria," Dr. Meade Bolton, formerly Associate in Bacteriology in Johns Hopkins University, and now bacteriologist to the City Board of Health of Philadelphia, contributes an interesting study to the *International Medical Magazine* for December, 1894. Following up the experiments of Nägeli, Miller and Behring, he has tested the bactericidal effect of various metals The following are some of his conclusions, stated as nearly as possible in his own words. For the most part agar plates were used and bits of metal were put on as soon as the agar was inoculated with the micro-organism and poured. In some cases the metals were absolutely pure, in some cases they were commercial but marked chemically pure, in one set brass foil was used, and a few preliminary experiments were made with impure metals. *Copper.*—In all cases there is around the metal a clear zone, in some cases narrower, in others wider, and then a narrow zone where there is increased growth. This intensified zone does not have as sharply marked borders as with certain other metals. Both the clear zone and the intensified zone vary appreciably in width, even with the same micro-organism. Tests were made with *Staphylococcus pyogenes aureus* and the colon, typhoid, cholera, and anthrax bacilli. *Brass.*—The zones obtained with the different micro-organisms were similar to those obtained with copper. *Silver.*—The results with this metal were somewhat less uniform than with copper and brass. The intensified zone is better marked with silver than with copper or brass, but is also narrower. In some cases with anthrax no clear zone was to be seen, in others there was a wide zone of lessened

[1] This department is edited by Erwin F. Smith, Department of Agriculture, Washington, D. C.